

Circumflex Coronary Artery Bypass Grafting Via Transverse Sinus

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Grafting the circumflex coronary artery has been more difficult technically than the right or anterior descending because of its posterior location and the angles of its marginal branches. However, grafting this artery has been substantially simplified by a method wherein the graft is passed directly through the transverse sinus and anastomosed to the back of the ascending aorta. This follows the most direct course to the ascending aorta and the graft is much shorter than one brought anterior to the heart. There is little chance of kinking the graft, since its angle of attachment is ideal, and due to the anatomical configuration of the transverse sinus, there is more room for the graft and compression is unlikely. This allows more room on the anterior surface of the aorta for grafts to other coronary arteries. This method has been used in 50 cases and blood flows have been excellent. Twelve of these cases have been restudied postoperatively and the grafts are patent.

IN ORDER for coronary bypass surgery to attain the clinical objectives of stopping angina pectoris and preventing or postponing myocardial infarction and/or death, the technical objectives of reestablishing adequate blood flow to viable myocardium must be without flaw. The majority of descriptions and details of the technical aspects of aorto-coronary saphenous vein bypass grafting have been concerned mainly with the details of creating the anastomoses.¹⁻³ Certainly this is a critical consideration in this operation, however, I do not believe that enough emphasis has been placed on certain other technical aspects of managing these grafts. These include graft length, angles of attachment, avoidance of graft kinking, and course of the graft taken from the coronary artery to the ascending aorta. Problems of this nature are relatively minimal with vein bypass grafting of the right coronary and its branches and the anterior descending

coronary and its branches. When grafting these two arteries, almost the only consideration necessary for the vein between the two anastomoses is that it be made long enough and, if so, it is easily placed in such a position as to avoid further problems. The graft to the right coronary usually assumes the course of the coronary artery, and if a relatively loose loop is placed in the anterior descending graft, it will assume, naturally, a good position over the pulmonary artery.

However, grafting the circumflex coronary artery has been more difficult technically because of its posterior location and the angles of its marginal branches. If this graft is brought anterior to the heart, its angle of attachment may not be ideal and there is much greater chance of kinking the graft or compressing it.

The purpose of this paper is to present a method which has simplified substantially grafting of the circumflex coronary artery.

Technique

The distal anastomosis is made using aortic cross-clamping and topical hypothermia. The graft is beveled and applied along the longitudinal axis of the recipient artery. If more than one of the marginal branches of the circumflex are to be grafted, the subsequent branch or branches are anastomosed side-to-side to the vein graft in sequence. The vein graft then is passed through the transverse sinus, which is the most direct route to the ascending aorta (Fig. 1). Care is taken at this point to

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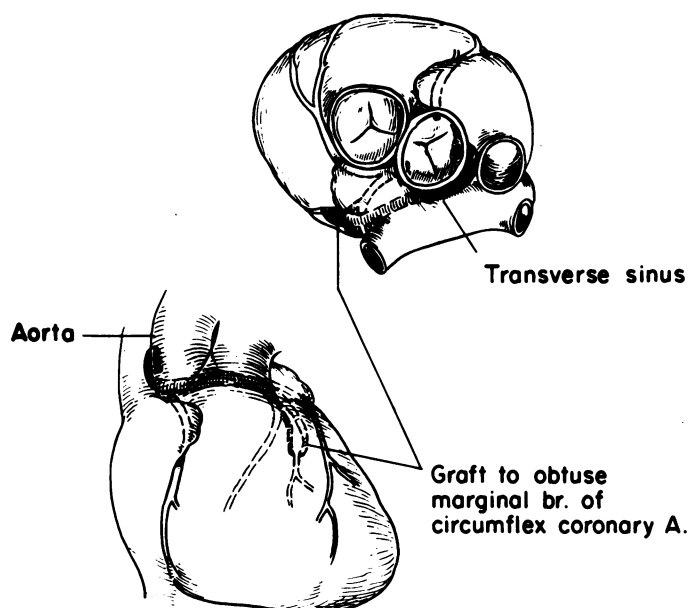


FIG. 1. Diagram showing vein bypass graft from obtuse marginal branch of circumflex coronary artery to ascending aorta via transverse sinus. Note anatomical relationship of transverse sinus and coronary arteries. Also, note direct route from circumflex coronary artery to ascending aorta and length of graft as compared to one looped anterior to the heart.

avoid twisting the graft. The aorta is unclamped and the heart is defibrillated. A bull-dog clamp is placed on the graft near the coronary artery, the vein is gently distended with blood, the heart is partially filled, and the length of the graft is carefully measured. The vein is cut squarely across at this point and the graft then is slit for 6–8 mm on its anterior surface. A partial occlusion clamp is applied to the back of the ascending aorta for the proximal anastomosis. This clamp usually is applied somewhat to the right of the true posterior and is applied just above the noncoronary sinus of Valsalva. Any problems with application of this clamp can be alleviated by reducing arterial inflow for a few seconds to allow aortic pressure to drop. I have used a relatively small partial occlusion clamp whose jaws are angulated slightly posteriorly. The aorta is then readily rotated with the clamp for excellent exposure for this anastomosis. The handles of the clamp are placed cephalad and the clamp usually can be attached to the left side of the drapes with a towel clip and does not require holding during the performance of the anastomosis. A 5–6 mm circular button of the aorta is removed with an adenoid punch, and the end-to-side anastomosis is made without difficulty. After the clamps are removed, both anastomoses and the entire length of the graft are inspected to insure hemostasis. Most of the time this graft cannot be seen readily when the patient is removed from cardiopul-

monary bypass and the heart is full, therefore, I have routinely measured blood flow in this graft while the patient is still on cardiopulmonary bypass. Almost always when the circumflex coronary artery is grafted, other coronaries are grafted as well, and I have found it somewhat better to do the circumflex first.

Results and Comment

This method for grafting the circumflex coronary artery has been used in 50 patients. Forty-one of these patients have had only one distal anastomosis to the circumflex, while the other 9 have had two or more distal anastomoses done in sequence. When only one distal anastomosis was made, blood flows averaged slightly over 80 cc per minute, and with two or more distal anastomoses, blood flows averaged slightly more than 120 cc per minute. Twelve of these cases have been restudied postoperatively and the grafts are patent.

I have encountered virtually no disadvantages to this method. Certainly care must be taken not to twist the graft, since it might not be detected after the circulation is returned to the heart. Length of the graft must be reasonably accurate, however, there is a fair amount of room in the transverse sinus and the distended graft readily seeks a position to avoid kinking. An extremely long graft should be avoided, but the main consideration regarding length is that it not be too short. Any concern regarding the performance of the proximal anastomosis is not warranted. The clamp is easily applied and the aorta is readily rotated for excellent exposure for this anastomosis and, surprisingly, I find it easier to make than an anastomosis placed on the anterior surface of the aorta. Concerns regarding hidden bleeding from this graft after the patient is removed from bypass are real. However, this is true of the distal part of the graft and the distal anastomosis to the circumflex, no matter what method is used. The proximal anastomosis can be visualized without much difficulty by rotation of the ascending aorta, and the partial occlusion clamp can be reapplied if necessary. With reasonable care, all of these potential problems are avoided and I have not encountered this in dealing with this group of patients.

The use of this method has simplified grafting the circumflex coronary artery for me. The graft is much shorter than one brought anterior to the heart and with actual measurement, is less than one-half as long. There is almost no chance of kinking the graft, since its angle of attachment is ideal, and due to the anatomical configuration of the transverse sinus, there is more room for the graft and compression is unlikely. Two separate grafts are readily accommodated if required. As a matter

of fact, on several occasions I have brought the vein graft from a proximal anterior descending diagonal sequence through the transverse sinus along with the circumflex graft and anastomosed it to the ascending aorta just above the circumflex graft. Using this course for the bypass graft to the proximal anterior descending and diagonal, has the same advantages as mentioned above. Obviously this allows more room on the anterior surface of the aorta for grafts to other coronary arteries.

DISCUSSION

DR. IVAN K. CROSBY (Charlottesville, Virginia): We have collected some of the data of the last three and a half years at the University of Virginia, and have found that we were putting in about 2.8 grafts per patient; so a lot of patients get circumflex grafts.

I think we've used this technique about 30 times, and it's been technically very satisfactory from our point of view. We haven't had any complications in terms of bleeding or early occlusion.

However, I think that it's not the perfect answer for the circumflex. I think the left atrial appendage sometimes gets in the way when you are putting a graft to the main circumflex artery distally in the atrioventricular groove; and I think in that situation the conventional anterior graft is more appropriate.

I think we can take a little more precaution in demarcating this anastomosis for our cardiologists, and we won't leave them wondering where that single silver clip is. We put a metal ring around that anastomosis, because I think they may have some difficulty finding that graft to restudy it.

I think that brings up the question of whether as many of these grafts

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stay open at one and two years as those placed in the conventional anterior position.

DR. ALLEN S. HUDSPETH (Closing discussion): I can't answer Dr. Crosby's question. Obviously, it's going to take a long time to answer many questions in coronary artery surgery. It obviously is going to prove to be a tremendous statistical surgical maneuver, and my point of view about it is that coronary artery surgery is not fun; the results of it are fun.

I have been working on this stuff commonly, day to day, and make many comments in the operating room. One of my favorite ones is that if Job had had to do this, he wouldn't have gotten very much publicity. So I don't know.

I think it is so critical technically. I think that this type of surgery probably is the most demanding technically that I have done. You can work for hours on these patients, and make one 1 mm error, and ruin the whole thing. That's what we're dealing with.

So I have thought that any technical consideration that seems beneficial in anyone's experience probably should be shared with others, and that was the reason for presenting this.